Computer Basics

MotherBoard Components
- **Expansion slots**
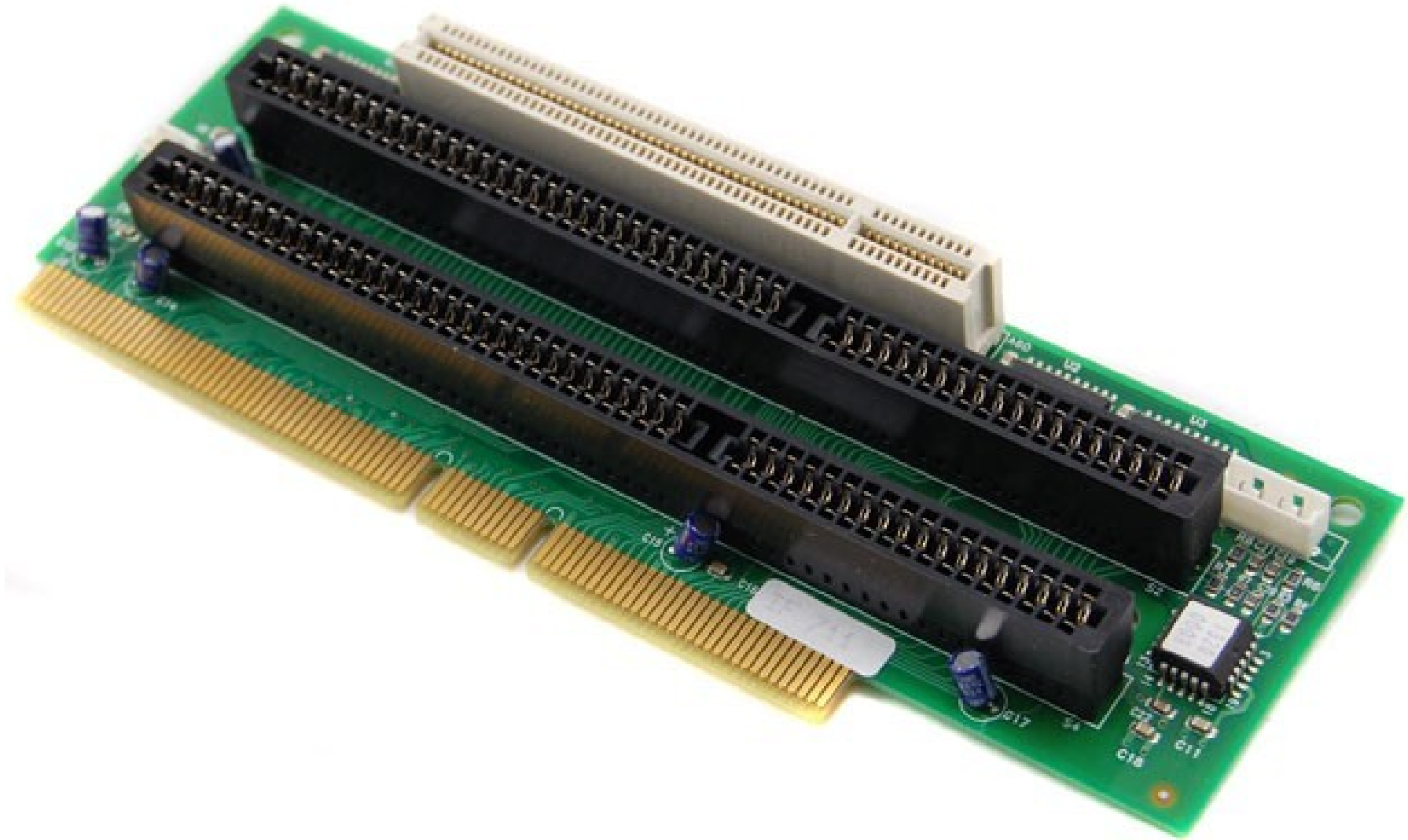
MotherBoard Components

Expansion slots

- The most visible parts of any motherboard.
- These are small plastic slots, usually from 1 to 6 inches long and approximately 1/2 inch wide
- used to install various devices in the computer to expand its capabilities
- the main types of expansion slots
  - ISA
  - PCI
  - AGP
  - PCIe
  - PCI-X
  - CNR

MotherBoard Components

Expansion slots

- **ISA (Industry Standard Architecture)**
  - Is the 8-bit and 16-bit internal bus of IBM and similar computers based on the Intel 80286 and its immediate successors during the 1980s.
  - Power lines included –5 V and ±12 V in order to directly support
  - ISA is still used today for specialized industrial purposes.
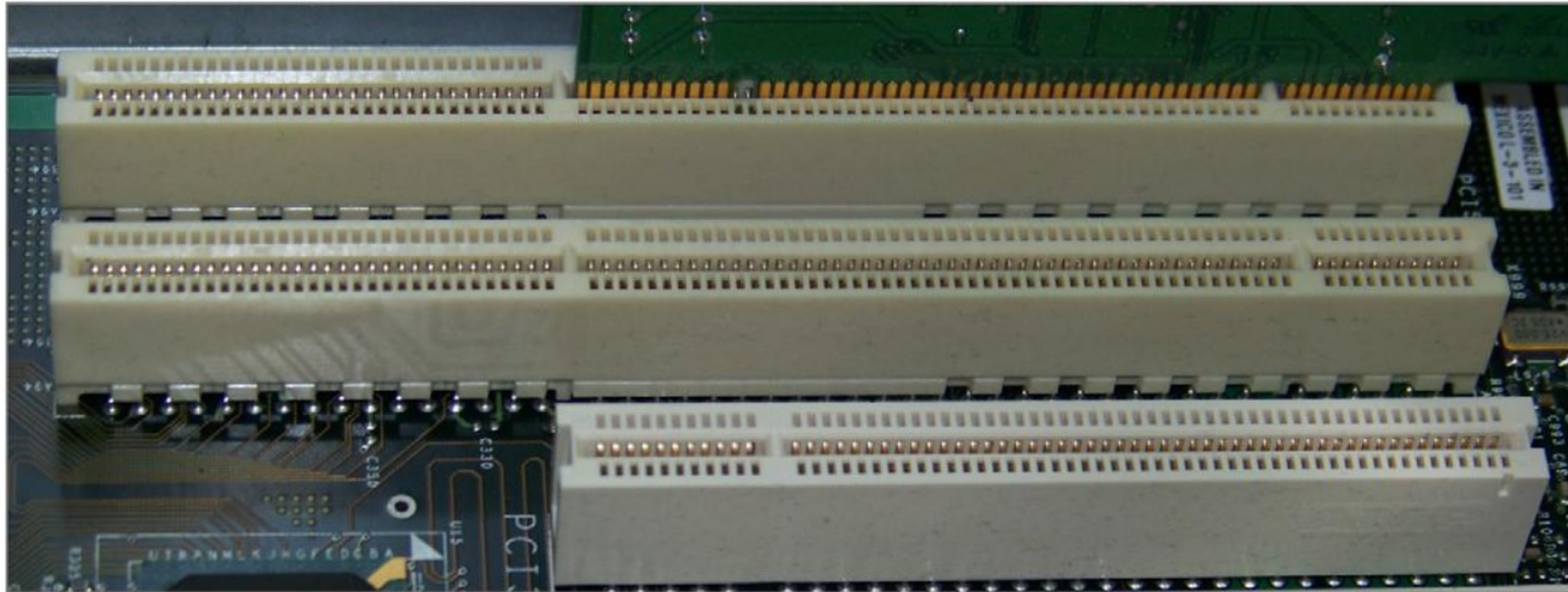
ISA Expansion Slots
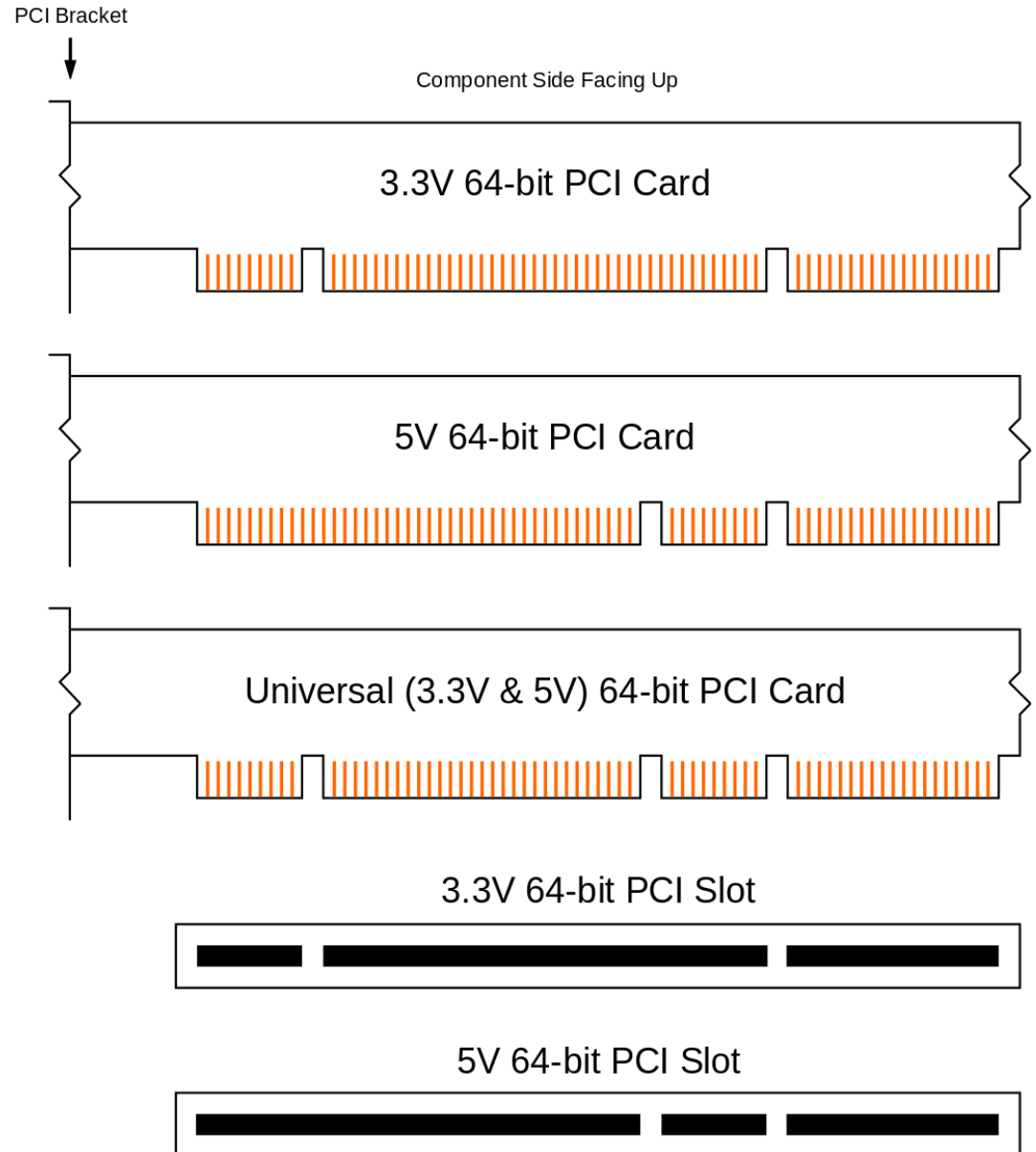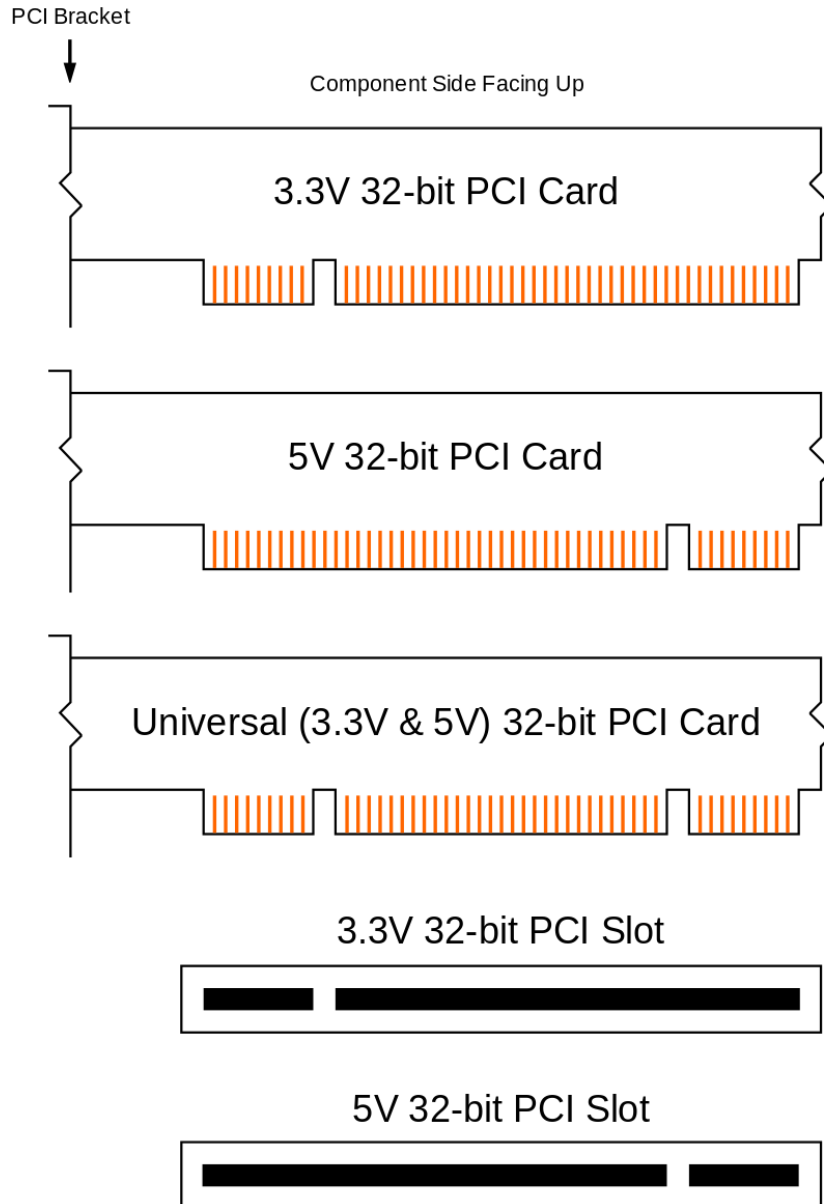
MotherBoard Components

Expansion slots

- **PCI (Peripheral Component Interconnect)**
  - Has two types: 32-bit cards and 64-bit cards
  - They are easily recognizable because they are only around 3 inches long and classically white
  - Usually located alongside the AGP slot
  - PCI slots became extremely popular with the advent of Pentium-class processors
  - The 32-bit version of PCI has a speed of 33 MHz with a transfer rate of 133 Mbps
  - the 64-bit version of PCI runs at 66 MHz with a transfer rate of 266MBps
  - One of the other major benefits of PCI is that it is a Plug and Play architecture
  - PCI slots and adapters are manufactured in 3.3 and 5V versions

PCI expansion slots

PCI expansion slots

PCI Bracket

Component Side Facing Up

3.3V 32-bit PCI Card

PCI Bracket

Component Side Facing Up

3.3V 64-bit PCI Card

5V 32-bit PCI Card

5V 64-bit PCI Card

Universal (3.3V & 5V) 32-bit PCI Card

Universal (3.3V & 5V) 64-bit PCI Card

3.3V 32-bit PCI Slot

3.3V 64-bit PCI Slot

5V 32-bit PCI Slot

5V 64-bit PCI Slot

MotherBoard Components

Expansion slots

- **AGP Advanced Graphics Port**
  - has been around since the Pentium II processor appeared in 1997
  - t's a 32-bit bus architecture that runs at 66 MHz, which is twice the speed of the PCI bus
  - The performance gain from the AGP port comes not only from the increase in speed, but also because the AGP bus has a direct path to the processor so that information travels quickly from the processor to the AGP card
  - They are also easily recognizable because they are usually brown and are located right next to the PCI slots
  - AGP 1x. It uses a 32-bit (4-byte) channel and a 66MHz clock, resulting in a data rate of 266MBps
  - AGP 2x has a transfer rate of 533 Mbps, AGP 4x has a transfer rate of 1.07 GBps, and AGP 8x has a transfer rate of 2.2 GBps!

AGP Expansion Slot

MotherBoard Components

Expansion slots

- **PCIe (Peripheral Component Interconnect Express)**

  - It was designed to be a replacement for AGP and PCI

  - PCIe has the advantage of being faster than AGP while maintaining the flexibility of PCI

  - Modern PCIe motherboards still tend to have regular PCI slots for backward compatibility, but AGP slots typically are not also included.

  - There are seven different link widths supported by PCIe, designated x1 (pronounced "by 1"), x2, x4, x8, x12, x16, and x32

  - With x1, x4, and x16 being the most common

  - There are three major versions of PCIe currently specified: 1.x, 2.x, and 3.0. The beginning of development on version 4.0 was announced in late 2011

  - You can insert a x8 card into a x16 slot. The x8 card won't completely fill the slot, but it will work at x8 speeds if up-plugging is supported by the motherboard.
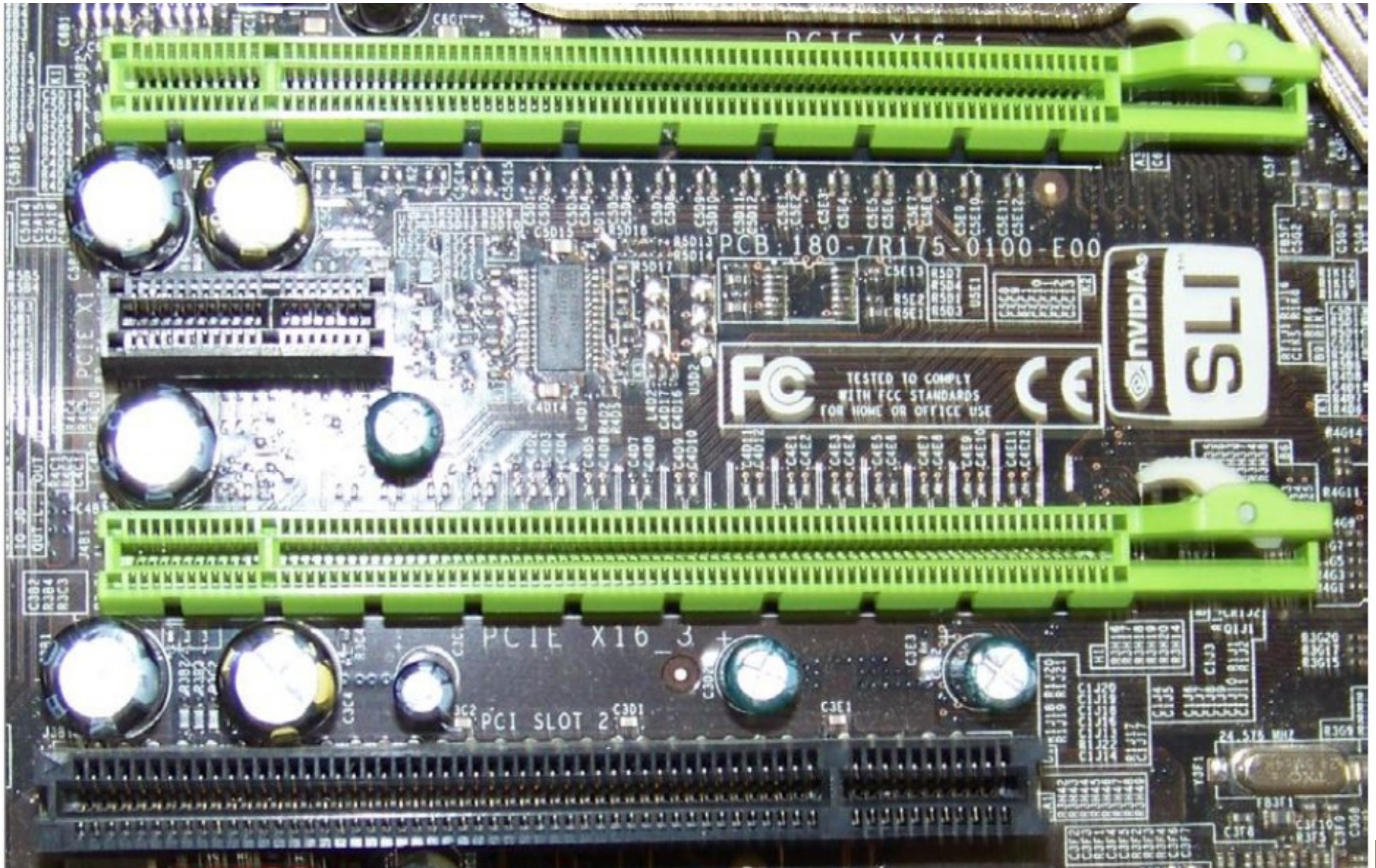
MotherBoard Components

Expansion slots

- **PCIe (Peripheral Component Interconnect Express)**

PCI Express link performance[33][34]

PCI Express version	Introduced	Line code	Transfer rate[i]	Throughput[i]				
				×1	×2	×4	×8	×16
1.0	2003	8b/10b	2.5 GT/s	250 MB/s	0.50 GB/s	1.0 GB/s	2.0 GB/s	4.0 GB/s
2.0	2007	8b/10b	5.0 GT/s	500 MB/s	1.0 GB/s	2.0 GB/s	4.0 GB/s	8.0 GB/s
3.0	2010	128b/130b	8.0 GT/s	984.6 MB/s	1.97 GB/s	3.94 GB/s	7.88 GB/s	15.8 GB/s
4.0	2017	128b/130b	16.0 GT/s	1969 MB/s	3.94 GB/s	7.88 GB/s	15.75 GB/s	31.5 GB/s
5.0[35][36]	expected in Q1 2019[37]	128b/130b	32.0 GT/s[ii]	3938 MB/s	7.88 GB/s	15.75 GB/s	31.51 GB/s	63.0 GB/s

https://en.wikipedia.org/wiki/PCI_Express

PCIe Expansion Slots

MotherBoard Components

Expansion slots

- **PCI-X (Peripheral Component Interconnect Extended)**
    - Visually indistinguishable from 64-bit PCI, because it uses the same slots.
    - It is totally compatible with PCI in the sense that it can hold PCI cards.
    - Like PCI, PCI-X is a 32-bit and 64-bit bus architecture and is available in four different speeds: 66 MHz, 133 MHz, 266 MHz, and 533 MHz.
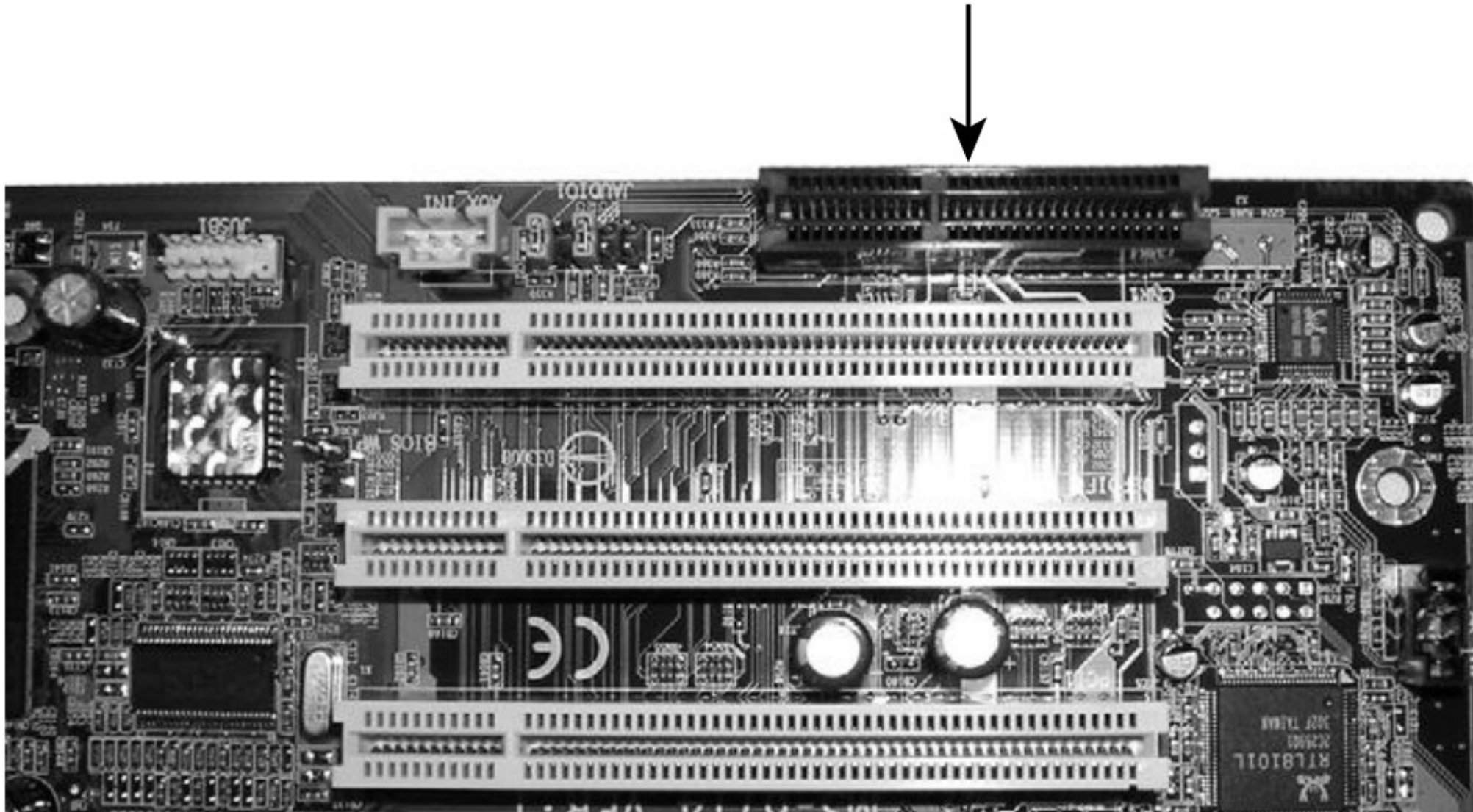   - It is important to note that PCI-X was largely a server bus architecture.

MotherBoard Components

Expansion slots

- **AMR and CNR**

  - Audio/Modem Riser (AMR) is a newer bus architecture that adds a modem and audio card to the system. AMR allows the two components to be incorporated into a single card to reduce cost.

  - Communication and Network Riser (CNR) is another bus architecture that has come out in recent years, used to implement LAN, audio, and modem functionality all in one.

CNR Expansion Slot

Thanks For Attention